

Performance Evaluation of 29- and 31-inch W-beam Guardrails behind Curbs under MASH TL-2 Conditions

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W-beam guardrails are widely-used safety devices on U.S. highways; they are typically comprised of a steel, W-shaped rail mounted on steel or wood posts. Although many W-beam guardrails satisfy the safety requirements of Manual for Assessing Safety Hardware (MASH) on flat surfaces, their performance in relation to their placement behind curbs remains an open issue. Since curbs can cause the striking vehicle to vault and experience suspension compression, the vehicle may override or under-ride the guardrail, depending on the guardrail's location and height as well as the (bumper) height of the vehicle. First, curbs elevate the height of the W-beam rail relative to the impacting vehicle. Second, curbs change the height of the impacting vehicle due to suspension compression and vaulting. Furthermore, the location (or offset) of the guardrail relative to the curb face significantly affects the guardrail's performance, particularly when considering different vehicle sizes. To this end, performance evaluation of W-beam guardrails based on flat-terrain testing cannot be directly used to guide guardrail installation involving curbs. Appropriate design and installation of the guardrail should account for the curb's geometry and vehicle sizes in order to reduce the potentially hazardous results of curb crashes.

In this study, FE models of a 29-inch and a 31-inch strong-post W-beam guardrail are created and used in simulations of full-scale vehicular impacts under MASH Test Level 2 (TL-2) conditions. Two guardrail placements behind curbs are investigated: one with the W-beam rail flush with the curb face and the other at 12-foot offset from the curb face. Two vehicle models, a small passenger car (1996 Dodge Neon) and a large pickup truck (2006 Ford F-250) are used in the simulations. The vehicles' responses and exit trajectories for all cases are assessed to determine the performance of the W-beam guardrails with different placements.

REFERENCES

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